NASA Procedural Requirements

COMPLIANCE IS MANDATORY

NPR 2570.1B
Effective Date:
December 05, 2008
Expiration Date:
December 05, 2013

Printable Format (PDF)

Request Notification of Change (NASA Only)

Subject: NASA Radio Frequency (RF) Spectrum Management Manual

Responsible Office: Space Operations Mission Directorate

Chapter 3: RF Allocations and Assignments

3.1 General

a. In order to effectively implement the national and international spectrum management policy, NASA has adopted procedures for requesting frequency assignments and for obtaining new frequency allocations. These procedures allow for a coordinated process starting with identification of Agency program/project needs and ending with national and international recognition of actual band usage.

b. For the purpose of this NPR, the terms frequency allotment, frequency allocation, and frequency assignment use the definitions adopted from the ITU Radio Regulations (RR) and provided for information in Appendix A.

c. In general, the frequency assignment process takes the form outlined in Figure 3-1 and is initiated at the user NASA Center and ends with issuance of a Radio Frequency Authorization (RFA) or Special Temporary Authorization (STA). If the use is not for a major terrestrial program or not for frequencies to be used for transmissions to and from space, the frequency assignment process is fairly simple as described in paragraph 3.3.b (2).

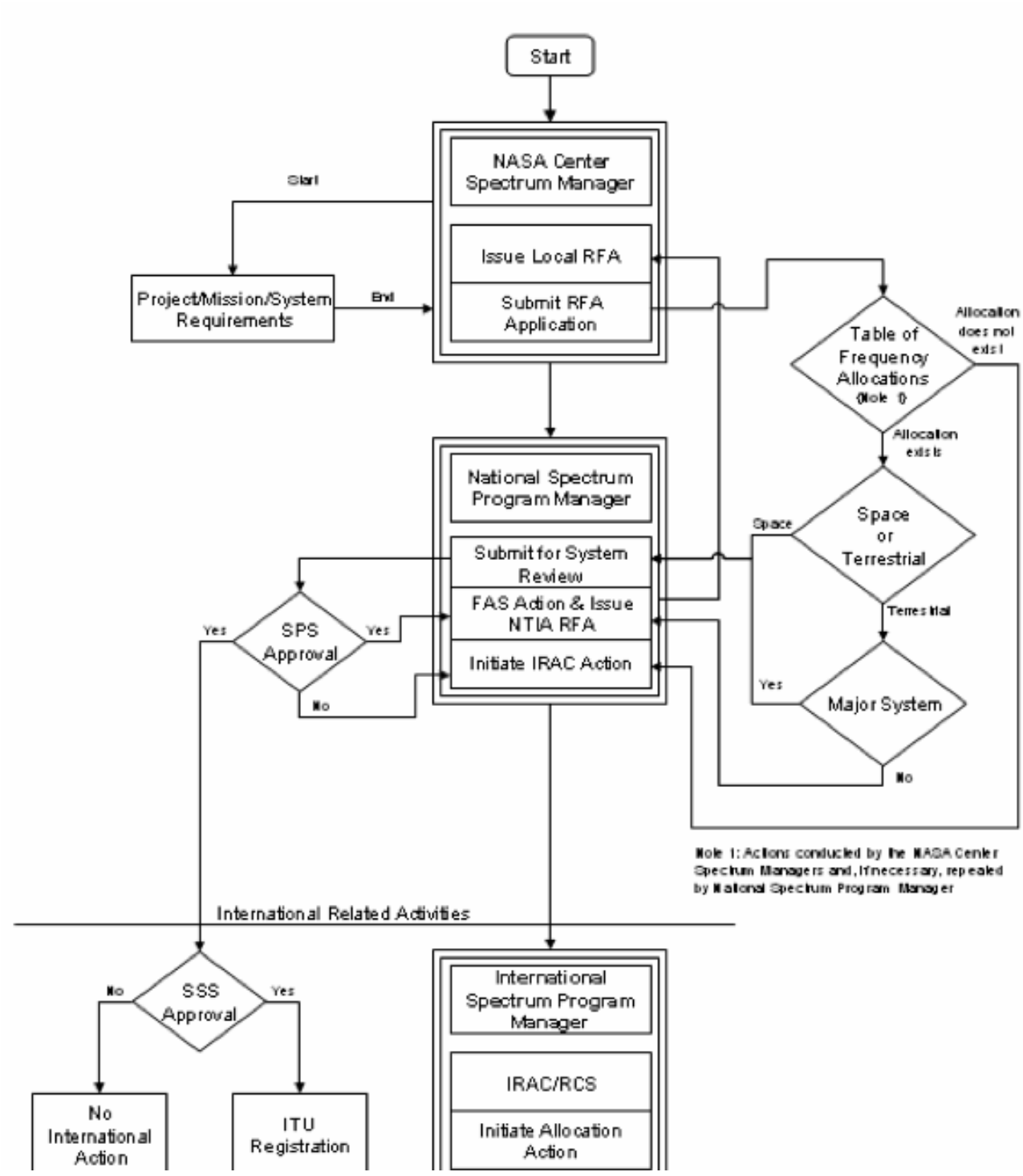
d. However, for major new programs or for programs involving spacecraft, NTIA has established a systems review process by which that use is coordinated within the United States and internationally. This process is described in Appendix G.

3.2 Frequency Allocations

In most cases, identification of RF spectrum support for Agency needs is focused on frequency bands currently allocated nationally and internationally for the particular radio service for which the Agency requires support. This includes both terrestrial use (in fixed and mobile allocations) and space use (in space services that support the U.S. space programs). However, in some

cases, particularly as new scientific, technological, and commercial requirements emerge and bands lower in the RF spectrum become congested, it may be necessary to move Agency operations elsewhere in the RF spectrum where appropriate allocations do not currently exist. As shown in Figure 3-1, the identification of the need for a new allocation may be made by reference to the Table of Frequency Allocations or as a result of the systems review process which includes a study of current frequency band occupancy.

In cases where new frequency allocations are deemed necessary, it is imperative that long-lead-times be allowed for the national and international processes which are required for new allocations to be made. While ITU conferences are competent to reallocate portions of the RF spectrum and occur on a periodic basis, it is essential that NASA is prepared to identify new requirements well in advance of these conferences so that supporting technical and regulatory arguments can be prepared and presented.



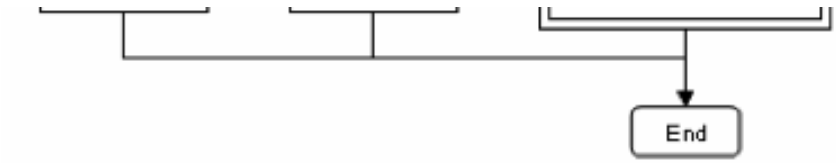


Figure 3-1 Frequency Authorization Process

3.3 Frequency Assignments

a. General

Specific procedures by which Agency users may be authorized to operate on a particular frequency depend upon the following factors:

(1) Whether a frequency allocation exists.

(2) Whether the system is terrestrial or spaceborne.

(3) Whether the system is considered a major telecommunications system, e.g., high investment.

(4) The duration of the system's operation.

Note: Using OMB regulations, the Center/Facility Spectrum Manager is responsible to ensure that the project completes and submits an economic cost/benefit analysis for each new frequency required. This analysis is done once for NTIA Spectrum Planning Subcommittee (SPS) Stage 2 certification (or at Stage 3 certification, if applicable).

b. Process for frequency selection prior to design commitment (See Figure 3.2)

(1) Project Commitment (Funding Approved)

The dissemination of information of project commitment made at NASA Headquarters or within NASA programs and projects is key to the successful coordination of design decisions involving the selection of frequencies for systems requiring RF communications. An economic analysis justifying the need for the specific frequency and bandwidth is required by OMB Circular A-11. The project / program office is responsible for the generation and availability to submit to the NTIA SPS during system certification. The economic analysis shall be completed by the project/program office and approved by the NTIA Administration before funding can be provided.

(2) Initial Frequency Coordination Guidance

Due to the increasing complexity and usage of the RF spectrum, the availability/cost of spectrum may actually drive the design requirements for future NASA missions. Each Center has a designated Radio Frequency Spectrum Manager who is responsible for obtaining, maintaining, and retiring the RFA for programs and projects at the Center; and for preventing or mitigating radio frequency interference at the Center or to the Center's programs to enable mission execution. The Center Radio Frequency Spectrum Manager provides guidance on the selection of properly allocated frequency bands to fulfill mission requirements. Once candidate frequency bands and Center frequencies are selected, the dissemination of the information is necessary to ensure that appropriate feedback is obtained to ensure timely resolution of problems from within NASA, as well as with other users of the spectrum.

(3) Dissemination of Candidate Frequencies

The dissemination of information about candidate frequencies should include the relevant NASA

Spectrum Managers at the Center level and the candidate Government or commercial launch sites that NASA may use in the future. The Center/Facility spectrum manager shall send their SPS submissions to the National Spectrum Program Manager, NASA's SPS representative, and alternate SPS representatives. This ensures that the NTIA's SPS concerns are addressed before the submission of a Systems Review. Spectrum Managers may also provide additional insight into scheduling issues for frequencies in highly congested bands requiring ground station support.

(4) Comments and Analysis of Frequencies

Projects should employ an approach similar to the RF analysis of the candidate frequencies (see Figure 3-2). Therefore, projects should be prepared to fund an RF analysis that may need to be conducted to ensure electromagnetic compatibility with other users of the proposed frequency band(s) of operation. The results of such an analysis should provide better information for the selection of the best frequency for a particular mission and should be included in a submission to the NTIA for a Systems Review.

(5) Initiate Spectrum Planning Subcommittee Process

The conceptual phase of a mission ends when the necessary analysis has determined the best frequency candidate for a particular mission. The planning phase then begins with an initial submission of a Systems Review (Stage 1 or 2) to the NTIA. The NTIA may provide further guidance or raise concerns regarding existing systems that may be incompatible with the particular mission. (See Appendix G of this NPR and Chapter 10 of the NTIA Manual).

NASA's SPS representative or alternate SPS representatives shall submit all Center/Facilities responses to questions from NTIA in order to ensure that items are tracked.

It is mandatory that all Centers/Facilities use NTIA's Equipment Location - Certification Identification Database (EL-CID) or current successor software program for the generation of NTIA Form 33 and 34. The Center/Facility is still responsible for the remaining System Review package as described in Chapter 10 of the NTIA's "Manual of Regulations & Procedures for Federal Radio Frequency Management." Note the spaceborne systems utilizing the 2200 MHz to 2290 MHz band are limited to bandwidths of less than 6 MHz, unless approved by the NTIA through a waiver. Justification is required by the NTIA before any system can be certified.

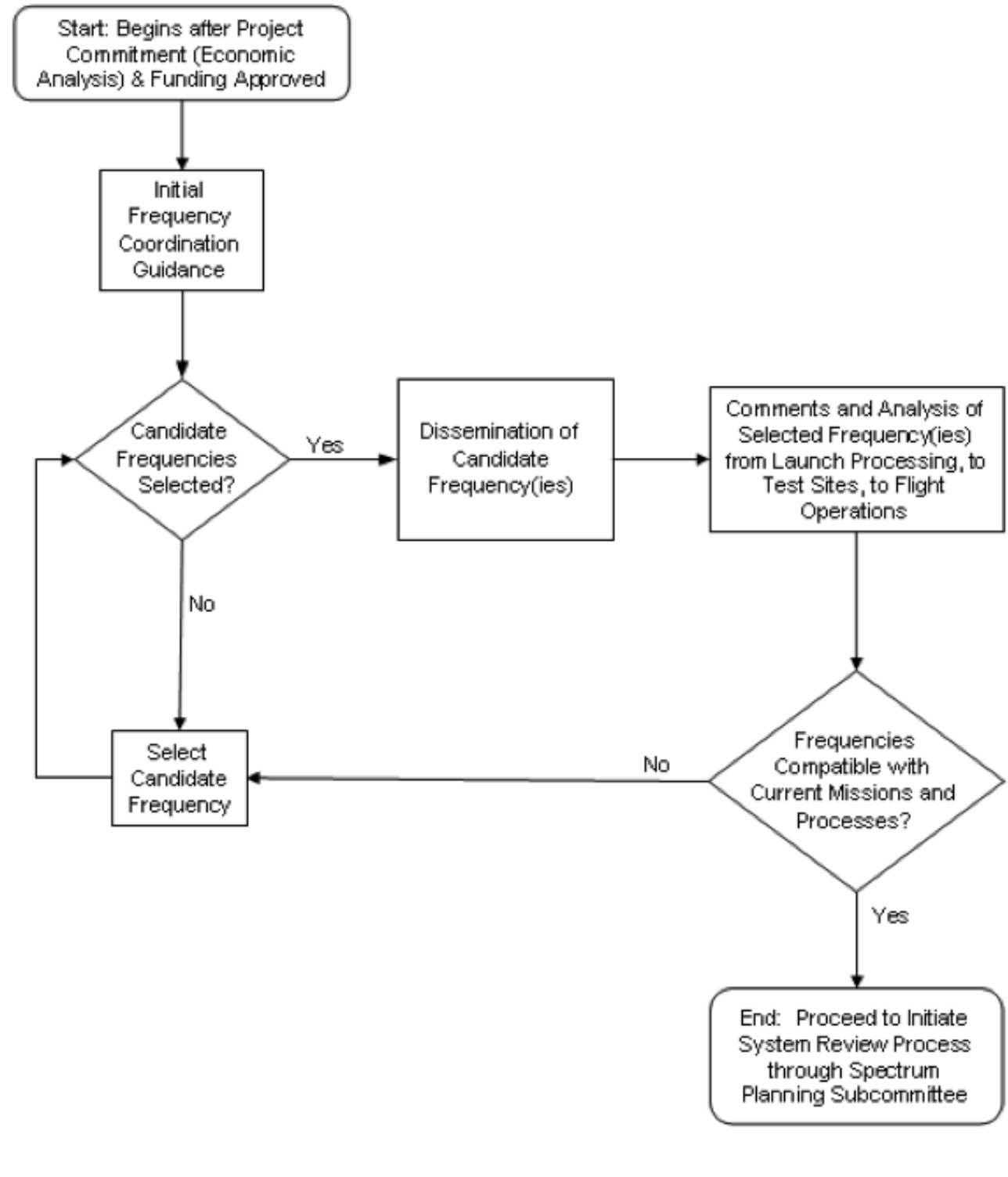


Figure 3-2 Process for Frequency Selection

c. Terrestrial Assignments

(1) Some terrestrial systems may be classified as major telecommunications systems. These are systems which, even though spectrum allocations currently exist, are required to be submitted to NTIA for a systems review because they have large bandwidth requirements, new modulation techniques, novel applications, or are considered to have a significant impact on the existing electromagnetic environment. This systems review procedure is referred to in Appendix G of this NPR.

(2) NASA users requiring assignments for radio frequencies for non-major terrestrial use should provide the specific technical information to the Center/Facility Spectrum Manager. This information should be submitted for all frequency assignment actions (new, renewal, and modifications) by the appropriate NASA Center/Facility Spectrum Manager for review and submission to the NASA FAS representative and alternate NASA FAS representatives in the proper NTIA computer mnemonic format as described in Chapter 9 of the NTIA Manual. It is mandatory that Center/Facility Spectrum Managers use NTIA's Spectrum XXI (or current successor) software program to request and receive radio-frequency assignments.

(3) The following procedures and notes will aid NASA spectrum applicants in the preparation of applications for frequency assignments, and facilitate the processing of the applications:

Step 1: From the operational requirements, determine the specific frequency or band of frequencies, together with alternate frequencies that would be acceptable if the desired frequencies are not available. Allow a lead-time of at least 60 work days for processing of typical land mobile radio operations and up to 180 work days for complex systems requiring pre-coordination with other Federal agencies. The time process commences when the application appears on the FAS electronic agenda.

Step 2: The Center/Facility Spectrum Manager will ensure that the frequencies are available and are in accordance with the National Table of Frequency Allocations. (Do not request "out-of-band" frequency assignments or allocations unless absolutely necessary and with written justification). In cases where out-of-band frequencies must be used, allow the maximum lead-time possible (240 days).

Step 3: Refer to paragraph 3.4 to determine if coordination with other users of the spectrum is required. The type and amount of coordination that might be required varies with the specific frequencies involved. When such coordination is extensive, the user (applicant) shall provide funds for such coordination, including the preparation of coordination contour charts.

Step 4: For each frequency assignment action required, submit the information to the NASA Center/Facility Spectrum Manager together with any other information that will aid in expediting the application.

(4) NASA Center/Facility Spectrum Managers and/or JPL Spectrum Manager are responsible for processing the information into the proper NTIA computer mnemonic format. For short term uses of RF equipment, the Center/Facility Spectrum Manager may determine that only a Special Temporary Authority (STA) is required. Submit this data via NTIA's Spectrum XXI (or current successor) software to the National Spectrum Program Manager.

(5) Submission of data or acknowledged receipt does not constitute an assignment or authorization regardless of any verbal agreements or understandings between the applicant and NASA spectrum management personnel. Do not attempt to operate on the frequency requested or to purchase equipment requiring such frequency support until authorized by formal RFA or STA issued through the Center/Facility Spectrum Manager.

d. Space Assignments

(1) Chapter 10 of the NTIA Manual entitled, "Procedures for the Review of Telecommunication Systems for Frequency Availability and Electromagnetic Compatibility (EMC) and Telecommunications Service Priority for Radiocommunications (TSP-R)" states that for Government agencies the systems review process is applicable to certain systems and subsystems. The systems review is intended for:

(a) New telecommunication systems or subsystems and major modifications to existing systems or subsystems, involving the use of satellites or spacecraft.

(b) New major terrestrial systems or subsystems and major modifications to existing systems or

subsystems.

(c) Such systems or facilities as may be referred to the SPS on a case-by-case basis.

Note: Telemetry, tracking, and control for spaceborne systems require a STAGE 4 (operational) system certification (from NTIA) before any spaceborne system is launched (even if the spaceborne system is experimental).

(2) The systems review is a procedure used by the SPS to develop recommendations, on behalf of the IRAC, for the Deputy Associate Administrator, Office of Spectrum Management of NTIA, regarding certification of spectrum support for telecommunication systems or subsystems. This review provides an early awareness in the regulatory community and allows for either early support or early identification of potential problems in the future. A system can be reviewed at four stages as it matures into an operational status. These are:

Stage 1. Conceptual

Stage 2. Experimental

Stage 3. Developmental

Stage 4. Operational

(3) This review process is mandatory for space systems except those that operate under Appendix K of the NTIA manual regarding low power nonlicensed devices. For those systems which require review and certification by the SPS, the Center/Facility Spectrum Manager shall be required to coordinate with the NASA SPS representative throughout the review process. The Center/Facility Spectrum Manager may request a waiver from the NTIA's SSS of the requirement to file the ITO notification, provided that the space system shall operate for less than one year.

(4) Details of the systems review procedure can be found in Appendix G.

3.4 U.S. Coordination Requirements

a. NASA Components as Tenants at Other Government Agencies

The Centers having joint tenant status at other Government agencies will coordinate frequency requirements with the host Government agency as required. Applications are then forwarded to the NASA National Spectrum Program Manager reflecting the recommendations of the host Agency under whose jurisdiction the operation is proposed.

b. Joint Radio Frequency Coordination for National Test Ranges

(1) The Department of Defense (DoD) has established a system of military interservice frequency coordination to minimize interference and to avoid conflict with or among radio and electronic operations at the DoD National Test Ranges. This system requires that certain frequencies shall be coordinated with DoD Area Frequency Coordinators (AFC) prior to the issuance of assignments. In the interest of economy and compatibility of operations, this system of coordination is used by NASA, in accordance with the joint DoD-NASA Agreement of July 28, 1980. Area coordinators are found in the NTIA Manual.

(2) The areas in which Military Interservice Frequency Coordination is required are shown in Figure 3-3 and further defined in Table 8.3.26 of the NTIA Manual. Table 8.3.26 also lists the DoD AFC responsible for coordination within each area.

(3) DoD AFC maintain current records of frequencies that have been coordinated with them for use in their area of cognizance. Upon request for frequency coordination, they supply technical comments on the probability of harmful interference being caused or received by the proposed

operations.

(4) All frequencies intended for use within the National Test Ranges (or within those areas delineated in Table 8.3.26 of the NTIA Manual) which are considered capable of causing harmful interference to operations at the specified test ranges, including any extended established "down-range" areas, are coordinated with the responsible DoD AFC. Area frequency coordination is accomplished by the Spectrum Manager of the NASA Center in accordance with the following procedures:

Step 1: When NASA operations require DoD range support and are to be conducted at sites under military cognizance, select the use of the frequencies required in coordination with the AFC of the range concerned. In the case of those military test facilities where there is no resident AFC, coordinate NASA frequency usage with the local Military Frequency Manager who will, in turn, effect the necessary coordination with the cognizant AFC.

Step 2: If the frequencies required are already assigned for use at the range concerned, the AFC (or local Military Frequency Manager) will effect local authorization and interference protection as necessary. When the frequencies required are not assigned to the range, the AFC will request assignment from the military department having cognizance of that range.

Step 3: Where NASA operations are to be conducted at sites not under military cognizance, but within the area defined in Table 8.3.26 of the NTIA Manual, coordinate the use with the AFC of the range concerned by providing system/emission characteristics for this purpose. The AFC will comment with due regard to all military frequency usage within the area involved.

Step 4: Forward system/emission characteristics in accordance with Chapter 9 of the NTIA Manual to the NASA FAS representative and alternate NASA FAS representative(s) for coordination with other users and IRAC as appropriate. Include a memorandum stating that coordination has been effected with the AFC involved. The National Spectrum Program Manager will apply for the assignments to cover these operations.

Step 5: Should a frequency conflict arise between DoD AFC and NASA Center/Facility Spectrum Managers and/or JPL Spectrum Manager that cannot be resolved satisfactorily through measures acceptable to the Center involved, forward a complete and detailed report to the National Spectrum Program Manager, NASA FAS Representative, and alternate NASA FAS representative(s) who will attempt to resolve the conflict at the Agency level.

c. Coordination Procedures for the National Radio Quiet Zone (NRQZ)

(1) The NRQZ is an area approximately 13,000 square miles set aside for radioastronomy observations. This area is bounded by 39°15'N on the North, 78°30'W on the East, 37°30'N on the South and 80°30'W on the West (Figure 3-3).

(2) To protect the NRQZ from interference, the following criteria have been established:

Based on a 20 kHz measurement bandwidth, the calculated power density of the transmitter at the reference point should be less than:

1 x 10 -8 W/m 2 for frequencies below 54 MHz

1 x 10 -12 W/m 2 for frequencies from 54 MHz to 108 MHz

1 x 10 -14 W/m 2 for frequencies from 108 MHz to 470 MHz

1 x 10 -17 W/m 2 for frequencies from 470 MHz to 1000 MHz

freq 2 (in GHz) x 10 -17 W/m 2 for frequencies above 1000 MHz

Except for frequencies that reside in the radio astronomy observing bands, in which case the power densities listed in Recommendation ITU-R RA.769-2 shall apply. The reference point is

located at 38°25' 59.2" N, 79°50' 23.4" W at 2,644 feet (806 meters) above mean sea level at a height of 458 feet above ground level.

For detailed information on the NRQZ, please see http://www.gb.nrao.edu/nrqz.shtml

For coordination questions, contact the NRAO Interference Office at 304-456-2107

(3) All proposed frequency assignments to NASA radio stations within the NRQZ shall be coordinated by the NASA FAS representative per the NTIA Manual Part 8.3.9, prior to authorization.

Figure 3-3 Geographic Locations of National Ranges and National Radio Quiet Zone

d. Coordination Procedures with the Aerospace and Flight Test Radio Coordinating Council (AFTRCC)

(1) Coordination procedures are applicable for all frequency assignment actions for use of frequencies in the bands 1435-1535 MHz and 2310-2390 MHz by U.S. Government radio stations within the conterminous United States, and are implemented to minimize, through local selection of frequencies and effective coordination, the possibility of interference.

(2) All frequency applications (proposed and renewal) for NASA radio stations shall be accompanied by an AFTRCC concurrence letter submitted in accordance with the NTIA Manual Chapter 8.3.17 and Annex D of the NTIA Manual.

3.5 NASA Contractors (NASA FAR Supplement, Subpart 1823.71 and Section 1852.223-71)

Center/Facility Spectrum Manager

The Center/Facility Spectrum Manager shall request the contracting officer to insert the clause from NASA FAR Supplement Section 1852.223-71, Frequency Authorization, in any contract which calls for the development, construction, or operation of a device for which an RFA or STA is required.

The Center/Facility Spectrum Manager shall provide to the contracting officer such technical assistance as may be required to enable the issuance of a radio frequency assignment.

NASA Contracting Officers

Commercial contractors, providing or operating RF equipment for NASA use, shall obtain RF spectrum authorization in accordance with the terms of the contract through the NASA contracting officer. Commercial contractors desiring to use Federal spectrum, as specified in the NTIA table of allocations (Chapter 4), are required to submit their needs to the Center/Facility Spectrum Manager. (The radio frequencies so approved do not belong to the contractor and are only for NASA use. Additionally, NASA shall ensure it maintains operational control of the radio equipment, should the need to cease transmissions arise.)

3.6 Foreign Frequency Assignments

Foreign frequency assignments shall be obtained by the senior NASA official available at, or convenient to, the site of operations. In some circumstances, NASA may request cooperating space agencies to obtain frequency assignments. Reports of all such actions will be made to the National Spectrum Program Manager, Washington, DC 20546.

3.7 Conditions of Assignment

a. All Center activities will be assigned frequencies by NTIA through the NASA FAS representative. The NASA FAS representative will forward these assignments, using NTIA-supplied software, Spectrum XXI (or current successor), to the appropriate Center/Facility Spectrum Manager upon completion of the frequency coordination process. The NASA FAS representative will also inform the National Spectrum Program Manager when the assignment has been approved by NTIA. Based on this authorization, Center/Facility Spectrum Managers may issue Center RFA's.

b. Additionally, a copy of the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management will also be supplied to all Spectrum Managers. Supplements to this manual will be furnished by the HQ Spectrum Management Office when published by the NTIA.

c. All NASA frequency assignments are issued subject to the following conditions:

(1) All frequencies assigned to NASA are issued subject to the conditions stated on the authorization. It is the responsibility of the Center/Facility Spectrum Manager to ensure that expiration dates are valid for their assignments and that, by September of each year, they perform updates via Spectrum XXI, (or equivalent successor) to any radio frequency assignment due for its five or ten year NTIA justification.

(2) Radio transmitters shall be operated by adequately trained and designated personnel and in a manner conforming to established and accepted procedures.

(3) Transmitter operations shall be conducted by personnel only on authorized frequencies after an assignment has been granted by the NTIA Frequency Assignment Subcommittee and

entered into the Government Master File (GMF) or a Special Temporary Authorization has been granted by NTIA.

(4) Approved power, emissions, and conditions of assignments shall be adhered to at all times.

(5) All land mobile radio transmissions shall be identified by the use of the authorized radio call signs pursuant to Appendix H of this NPR.

(6) Transmitter operations shall be held within the prescribed tolerances outlined in Chapter 5 of the NTIA Manual unless otherwise authorized.

(7) A copy of the current RFA for each fixed radio station should be posted or retained in some manner at the principal control point of each radio transmitter or station.

(8) An RF evaluation should be conducted to determine the effects on human health, including interference with personnel operations such as maintenance procedures. Evaluations shall be handled at a local level with the Center/Facility Spectrum Manager and in collaboration with the Center/Facility Radiation Safety Officer. Local procedures will vary at each site and, as a minimum, follow ANSI C95.1, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields."

d. Chapter 7 paragraph 11, of the NTIA Manual outlines conditions under which specific frequency usage may be authorized without prior coordination with other Government agencies. The Center/Facility Spectrum Managers may issue local RFA's without referral to the National Spectrum Program Manager to cover those operations that meet the criteria established in this chapter of the NTIA Manual for the particular frequency usage involved.

e. All Ground Penetrating radar and Global Positioning Satellite re-radiators shall receive NASA and NTIA approval prior to use (see NTIA Manual).

3.8 Emergency and Wartime Procedures

Emergency Procedures

(1) Under a declared emergency condition, Center/Facility Spectrum Managers may use or assign to an operation under their direction, frequencies not otherwise authorized, provided that:

(a) The nature and duration of the requirement are such that the normal frequency assignment procedures are impractical.

(b) All reasonable measures are taken before such frequencies are used to ensure that harmful interference will not be caused to other users.

Wartime Procedures

(1) In wartime, all radio frequencies, both Federal and non-Federal, may be under the centralized authority of NTIA. Normally, under such conditions, military operations will take precedence over nonmilitary operations. However, all priorities established by NTIA take into account all aspects of the President's communications requirements for the national defense in time of war.

(2) NASA's role in providing support for these wartime procedures is established through NTIA by the NASA Director of Spectrum Policy and Planning and will be implemented as required. The specific procedures are beyond the scope or intent of this NPR.

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